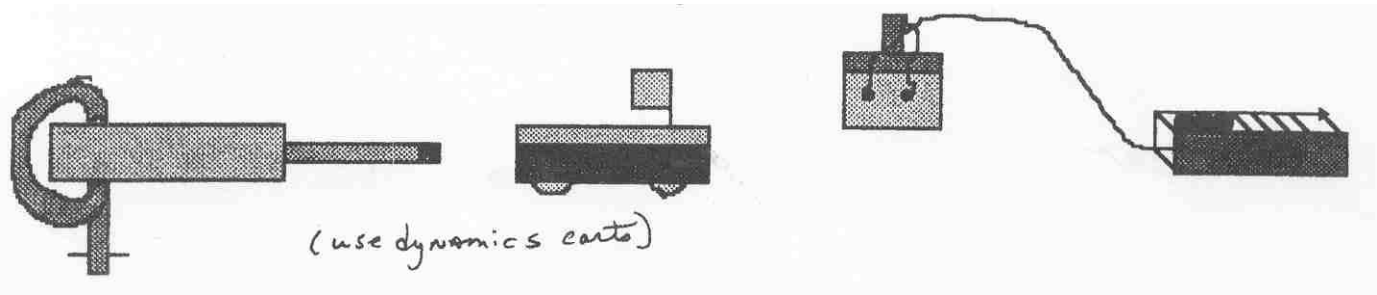
Ch. 11

LAB - ELASTIC POTENTIAL ENERGY converted to KINETIC ENERGY OF A LAB CAR

NAME: _____

PURPOSE: The purpose of this lab is to investigate the conservation of energy when elastic energy stored in a spring is converted to Kinetic Energy of a lab car.

SETUP: You should get the spring-loaded dynamics cart. Put the cart against a stable surface and let the spring propel the cart. The lab car should have a flag of some sort on its top mounted so that the flag will pass through a photogate. A simple index card with two leading edges cut 5.0 cm apart taped to the side of the cart will do very nicely. The photogate will be used along with the Partlett timer to get a measure of the velocity of the lab car immediately after the spring has finished pushing it to its final velocity. First, you will need the ULI with a force probe interfaced to it. Plug the force probe into channel DIN 1 of the ULI box. The arrangement will probably look something like the diagram below.



PROCEDURE: Call up the *Logger PRO* software to run this force probe. Click on the DIN1 channel and select the Dual Force sensor 50N. You may want to calibrate the force probe so that it records positive forces when you hold it in your hand and push. You will need a 1 kg mass (9.8 N) to do this. After calibration, click on *Setup* in the menu bar and with *Select Channels,* choose *Events with Entry.* Close all windows except the Plotter graph, which should now be a graph of Force vs. Distance. Set the distance to go from 0.0 to 0.15 m. The force should go from 0.0 to 15.0 N. This will allow you to tell the computer to record forces exerted by the spring at specific distances. Hold the Force Probe in your hand and push the plunger **almost** all the way into the wood block. Have the end of a meter stick clamped to the table so it is lined up with the end of the plunger.

Click on the red **COLLECT** button in the menu bar. The software will be recording force values but waits until you click on the **KEEP** button to keep any values. After you click on **KEEP**, type in the value of the position you have set the force probe. This will be 0.0 for the first point. (Remember to type the value of the distance in meters). The computer records both the force and distance at this point and plots it on the graph. Move the Force Probe out one-half centimeter at a time. **KEEP** the force and distance at each successive point.

When you have gone to the point where the plunger no longer exerts a force (about 11 cm), record this distance as the point of zero force and then **STOP** the experiment. Integrate the graph from the beginning to the end. This should tell you how much work the spring will do when it is allowed to push on the lab car. Record this total work value in the **DATA TABLE**.

Set up the photogate plugged into DG1 so the lab car will pass its flag through the photogate after the spring has finished pushing.

The velocity of the lab car is calculated by dividing the distance between the leading edges of the flag by the "delta Time" you get from the computer timing.

DATA TABLE

WORK STORED IN THE SPRING (J)	MASS OF THE LAB CAR (kg)	VELOCITY OF THE LAB CAR (m/s)	KINETIC ENERGY OF THE LAB CAR (J)	PERCENT DIFFERENCE BETWEEN STORED WORK AND KINETIC ENERGY

ANALYSIS:

Qt. Why should the Kinetic Energy of the Lab Car be the same as the Work Stored in the Spring?

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Q2. If you pushed the Spring back only halfway, how much work would the spring do on the Lab Car?

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Q3. If you pushed the Spring back only halfway, what would the velocity of the Lab Car be at the end of the push?

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Q4. Mark the plunger at the half way point and try this experiment. What is the velocity of the Lab Car? Is the velocity what you expected?

VELOCITY: _____

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